Vector-Borne Disease Report

West Nile Virus, Lyme disease and Eastern Equine Encephalitis Surveillance and Control Activities in Middlesex-London

Summary and Outcomes

2014

BUREAU DE SANTÉ DE MIDDLESEX-LONDON HEALTH UNIT
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For information, please contact:
Iqbal Kalsi, Manager
Environmental Health
Middlesex-London Health Unit
50 King St. London, Ontario N6A 5L7
Phone: 519-663-5317, ext. 2650
Fax: 519-663-9276
E-mail: Iqbal.Kalsi@mlhu.on.ca

Middlesex-London Health Unit
50 King St. London, Ontario N6A 5L7

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Acknowledgements

Report Authors

Jeremy Hogeveen
Vector-Borne Disease Coordinator

Elizabeth Milne
Vector-Borne Disease Field Technician

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Executive Summary

Each season the Middlesex-London Health Unit's (MLHU) Vector-Borne Disease (VBD) team continues to identify vector-borne disease activity and vector species in the region. Due to the increasing distribution of vector species and the local impact caused by West Nile Virus (WNV) and Lyme disease (LD), a comprehensive approach is required in order to prevent and mitigate resident exposure to diseases caused by mosquito and tick bites. This indicates that continued surveillance, sample identification and larvicide treatments are required to prevent disease transmission. In addition, the MLHU works to increase knowledge capacity and preventative behaviours by enhancing education campaigns and community partnerships. In 2014, the VBD program included new strategies which aimed to increase preventative behaviours and expand the scope of local surveillance and vector management.

The Vector-Borne Disease team promoted awareness by attending public education events, working with community partners and distributing educational and promotional materials. Overall, the VBD team reached approximately 9,000 people at 11 community events. An AdTube campaign to promote Lyme disease awareness ran for the months of May, June and September. This campaign consisted of a Lyme disease Public Service Announcement (PSA) that played to users prior to watching a YouTube video. The PSA was successful in generating over 190,000 impressions, 20,000 views and reaching two target demographics. The MLHU also identified a 41% increase to Lyme disease webpage views on the Health Unit's website. The VBD program was featured in the media on 27 occasions and news stories raised awareness about VBD activity in the community, encouraging residents to practice personal protection and reduce exposure to mosquito and tick bites.

In 2014, activities to monitor and prevent WNV included: surveillance and control of vector mosquito larvae at standing water sites and in catch basins, adult mosquito trapping and viral testing and dead bird submission and testing. All samples collected in the field were identified and/or tested for WNV by the VBD team and its service provider. These activities informed the application of 518 larvicide treatments to standing water and 97,804 treatments to roadside catch basins. Field surveillance also assisted in detecting 4 WNV-positive adult mosquito traps and 4 WNV-positive dead birds. Targeted surveillance and control of vector mosquito populations included weekly visits to 241 standing water sites. When surveillance data helped to identify positive activity in the community hotspot adult mosquito traps were set up to increase monitoring efforts and further identify any additional vector mosquito populations. Successful control of vector mosquito larvae ultimately decreases the number of biting adult mosquitoes, mitigating the potential risk of WNV transmission to the public.

Lyme disease and tick surveillance included a combination of passive and active strategies, such as tick intake and identification and follow up tick dragging when blacklegged ticks are acquired within Middlesex-London. Comprehensive LD surveillance assisted in identifying 20 blacklegged ticks this season (a 65% increase from 2013). Four of the blacklegged ticks identified were acquired locally (London, Komoka, or Denfield). As a result of increased locally acquired blacklegged ticks, the VBD team conducted 10 tick drags this year. The passive and active strategies assisted in building local surveillance data, identifying trends and raising awareness about local tick populations in the community.

The distribution of blacklegged ticks continues to expand in Ontario and in Middlesex-London. The VBD team continued to emphasize the identification of LD signs and symptoms, including proper tick removal, submission and the practice of personal protective behaviours. These activities were promoted at community events and during customer service investigations. Each season the MLHU continues to receive reports of travel-related human LD cases and/or blacklegged tick bites acquired while travelling. This finding has led to emphasizing personal protection messages to residents who spend time outdoors and to those who travel to regions outside of Middlesex-London. There are nearby risk areas for LD and blacklegged ticks in regions favoured for camping and leisure activities by local residents during the tick season.

In 2014, the VBD program started using Hedgehog, a database system to record and track Customer Service Requests (CSRs). In total, 250 Customer Service Requests were received and investigated by the VBD team. Customer Service requests included standing water reports and investigations, dead bird submission and testing, personal protection inquiries, tick submission and identification and general vector-borne disease inquiries. At the completion of each CSR investigation, the VBD team provided tools and resources to increase client knowledge capacity and the ability to identify and remediate WNV and LD risk factors.

1.0 West Nile Virus

Key Messages:

- 1,080 viral tests were conducted on adult mosquitoes.
- 4 WNV-positive mosquito traps were detected.
- 4 WNV-positive birds were detected.
- Reduced WNV vector species in the community by managing mosquito larvae at 241 standing water sites.
- No WNV human cases were detected in Middlesex-London.

Background

The Middlesex-London Health Unit's Vector-Borne Disease (VBD) program uses an Integrated Pest Management (IPM) approach to monitor and control vector mosquito larvae. A comprehensive local surveillance program aims to reduce adverse health outcomes associated with WNV related illness. In order to detect and reduce exposure to West Nile Virus in the community the VBD program emphasizes:

- public education,
- adult mosquito trapping and viral testing,
- dead bird surveillance and testing,
- weekly standing water surveillance and the collection/identification of mosquito larvae,
- control of vector mosquito larvae in standing water on public property, and
- surveillance mapping of adult mosquito trap locations and standing water sites.

West Nile Virus (WNV) is transmitted through the bite of an infected mosquito. The transmission cycle begins when vector mosquitoes feed on the blood of an infected bird. Only vector mosquitoes can transmit WNV from a bird to a human. Once a mosquito bites an infected bird, it can carry WNV and possibly transmit the virus to humans. (PHAC, 2014b)

A 'vector' is a mosquito species that can transmit disease through a mosquito bite. Not all mosquito species are vectors. A 'non-vector' or 'nuisance mosquito' cannot carry or transmit disease to humans. The main mosquito vectors for WNV in Ontario are *Culex pipiens* and *Culex restuans*. *Culex pipiens/restuans* can be found in significant numbers throughout Middlesex-London and in various structures. Typically, they prefer to breed in artificial containers such as catch basins or storm water management facilities. In the summer months, several generations of *Culex pipiens/restuans* are observed, increasing the viability of hosts for WNV transmission in Middlesex-London.

The Ministry of Health and Long-Term Care has listed 20 different mosquito species capable of transmitting WNV. At least 15 of these vector species are commonly identified in the summer months in Ontario. Thirteen (13) of these species or species groups were found in varying numbers throughout Middlesex-London in 2014. (MOHLTC, 2008; GDG, 2014)

Human Surveillance

The MLHU conducts human surveillance and collects epidemiological information to understand the incidence, prevalence, source and cause of local infections. This assists in determining the biological and environmental risk factors for acquiring WNV. The Public Health Agency of Canada's (PHAC) WNV case definition is used by healthcare providers to diagnose WNV. In Canada, WNV is a provincially reported disease and a Communicable Disease under the *Health Protection and Promotion Act*. (PHAC, 2014c) Physicians are required to report all suspected, probable, and confirmed cases of WNV to the local Medical Officer of Health, who then reports the cases to the Infectious Diseases Branch of the Ontario Ministry of Health and Long-Term Care (MOHLTC). (PHAC, 2014d; MOHLTC, 2014b) West Nile Virus infections are classified into three infection types:

- West Nile Virus Neurological Syndrome (WNNS).
- West Nile Virus Non-Neurological Syndrome (WN-Non-NS).
- West Nile Virus Asymptomatic Infection (WNAI).

West Nile Virus Neurological Syndrome and West Nile-Non-Neurological Syndrome cases may be classified as suspect, probable, or confirmed, and West Nile Virus Asymptomatic Infection cases as probable or confirmed. Both clinical symptoms and laboratory findings are based on blood work, and must be interpreted in order to reach a diagnosis. Specific criteria must be met in order to classify a case as suspect, probable, or confirmed.

Procedures

When a human is diagnosed with WNV, the MLHU's Infectious Disease Control team will begin an investigation. Preliminary actions include:

- Notifying the MOHLTC through the Integrated Public Health and Information System (iPHIS).
- A comprehensive assessment of the case's travel history and recent blood donation history.
- A review of symptoms with the patient.

Results are then forwarded to the MOHLTC, where they review the blood donation history of the patient. Canadian Blood Services is also notified of any human, mosquito, bird, and sometimes equine WNV diagnosis to provide a more complete picture of WNV presence in the community.

Upon laboratory confirmation, the MLHU conducts interviews with the patient to determine exposure information, such as the client's age, risk factors, history, and any hobbies or activities which may have been case for exposure. (PHAC, 2014d) Following the identification of exposure, the VBD team will conduct follow up field surveillance which includes: hotspot adult mosquito trapping, increased standing water control and issuing alerts.

Signs and Symptoms

Most humans infected with WNV will be asymptomatic or have mild symptoms (non-neurological). Other cases may progress to severe symptoms such as encephalitis. The extent and severity of symptoms varies from person to person. (PHAC, 2014d) Symptoms can develop 2 to 15 days after being bitten by an infected mosquito. Mild symptoms include:

- fever,
- headache,
- body aches,
- mild rash, and/or
- swollen lymph glands.

A few people will experience a severe form of infection called encephalitis (swelling of the brain). Severe symptoms include:

- stiff neck,
- nausea or vomiting,
- difficulty swallowing,
- drowsiness,
- confusion,
- loss of consciousness,
- muscle weakness,
- reduced muscle coordination,
- blurred eyesight and/or,
- numbness.

People of any age or health status can contract WNV; however, the overall risk for serious infection does increase with age. Those with weakened immune systems are also at greater risk for serious symptoms. Some people who develop mild symptoms can recover completely, within a week, while others may experience prolonged health problems and recovery can take up to a year for more serious cases. Prolonged health problems may occur in more serious cases. Some cases of severe disease can be fatal. (PHAC, 2014d) Human infection typically occurs by mid-summer or towards the end of a season once the virus has amplified within local mosquito populations.

Results

Due to normal temperatures, with no significant spikes to accelerate viral incubation in hosts, in addition to larvicide control of vector species, there was less WNV activity in the community in general, which resulted in no West Nile Virus human cases reported to the MLHU in 2014. [**Table 1**]

Table 1: WNV human cases 2004 to 2014.

Year	WNV-Positive Human Cases		
	MLHU	ONTARIO	CANADA
2014	0	10	21
2013	3	53	115
2012	7	252	450
2011	2	72	110
2010	0	5	9
2009	1	4	13
2008	0	4	38
2007	1	15	2215
2006	3	42	151
2005	3	101	238
2004	0	14	26
2003	1	89	1495
2002	9	394	414

Larval Surveillance and Identification

- Surveillance began March 30 and concluded October 3, 2014.
- 11,993 mosquito larvae were identified from standing water sites monitored by the MLHU.
- 56% were vector species.
- 44% were non-vector species. [**Figure 1**]
- 71% of mosquito larvae identified since 2004 have been vector species. [**Figure 2**]

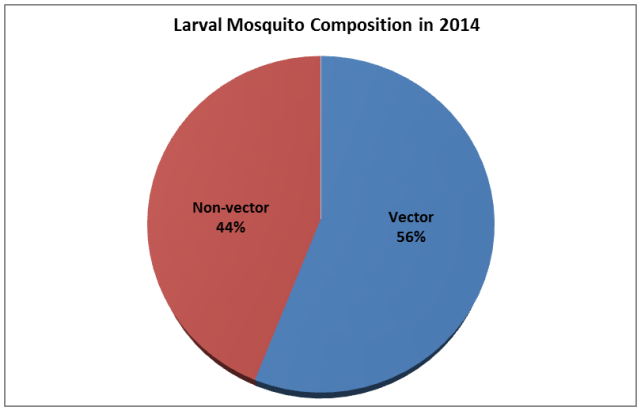


Figure 1: Vector and non-vector mosquito composition.

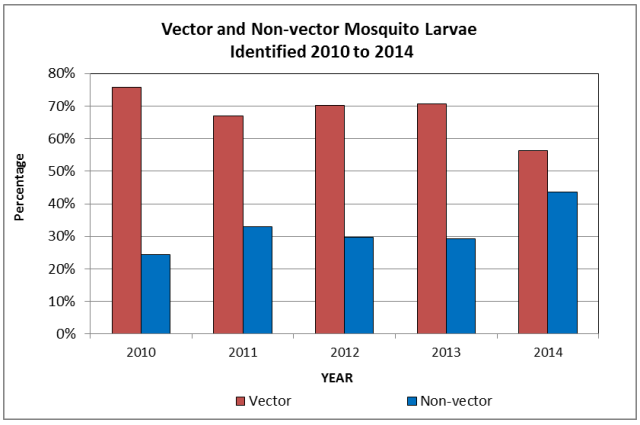


Figure 2: Vector and non-vector mosquito composition 2010 to 2014.

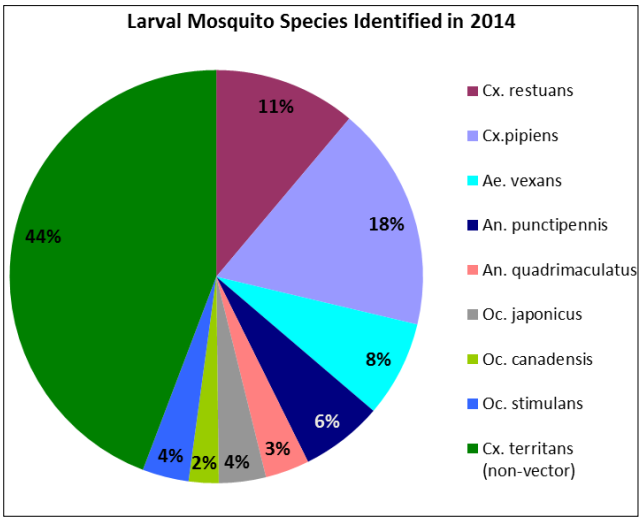


Figure 3: Larval mosquito species identified in 2014.

- 29% of mosquito larvae identified in 2014 were the primary vector species for WNV; *Culex pipiens* (18%) and *Culex restuans* (11%). [**Figure 3**]

Adult Mosquito Surveillance

- Adult mosquitoes were collected June 3 to September 24, 2014.
- 23 traps were set up at 17 sites on a weekly basis for a total of 12 weeks. [**Appendix A**]
- Traps were equally distributed throughout the City of London and Middlesex-County.
- 552 site visits were made to adult mosquito habitat to collect samples for WNV testing.
- 6 hotspot mosquito traps were set up, all negative for WNV.
- 45,952 adult mosquitoes were collected by the MLHU and sent to GDG Environnement for identification and viral testing.
- 48% were identified as vector species.
- 52% were identified as non-vector species.
- 9,874 vector species were identified from samples collected in Middlesex-London.
- A total of 1080 pools of vector mosquito larvae were tested for WNV this season.
- 4 traps (pools) of vector mosquito larvae tested positive for WNV [**Figure 4: Appendix B**]
- The four main species tested for WNV in 2014 were *Cx. pipiens/restuans* (266 pools tested), *Oc. japonicus* (75 pools tested), *Ae. vexans* (354 pools tested) and *Oc. trivitattus* (121 pools tested).
- The species testing positive for WNV in all 4 traps were *Culex pipiens/restuans*.
- 1,984 adult *Culex pipiens/restuans* were captured in 2014 (7% of species abundance).

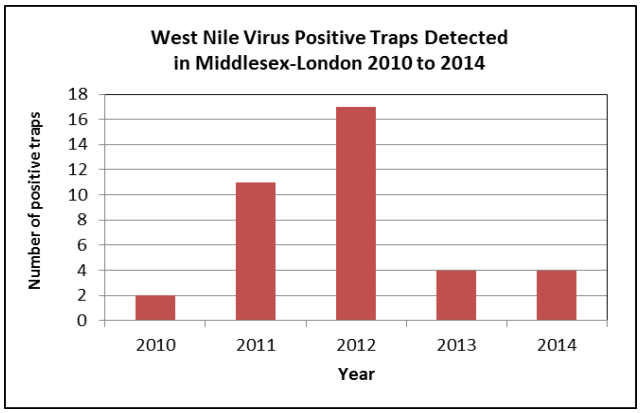


Figure 4: WNV-positive traps detected in Middlesex-London from 2010 to 2014.

- *Aedes vexans* represented 21% of the total capture. [**Figure 5**] This was the largest group of mosquito species tested (4,985 mosquitoes tested). [**Figure 6**] The development and emergence of this species is triggered by precipitation events.
- The second largest group tested were *Cx. pipiens/restuans* (1,685 mosquitoes tested).*Culex pipiens/restuans* are the primary vectors for WNV and represented 7% of the total capture. [**Figure 5**] These species predominantly develop in catch basins and artificial structures but can also be found in other areas of standing water throughout Middlesex-London. (GDG, 2014; Turell, O'Guinn, Dohm & Jones, 2001)

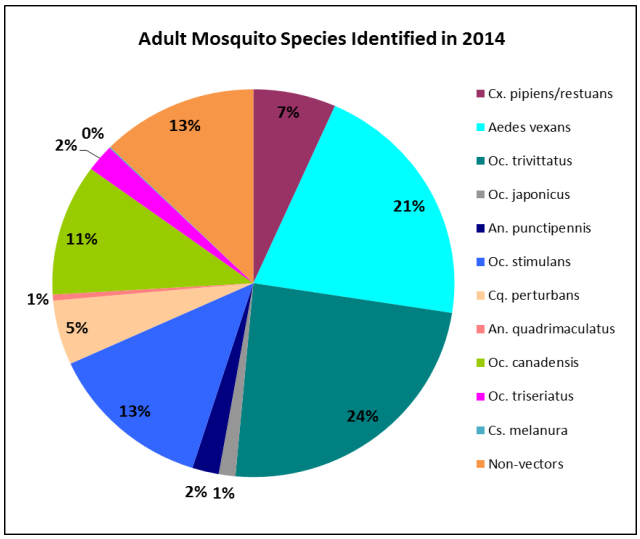


Figure 5: Adult mosquito species identified in 2014.

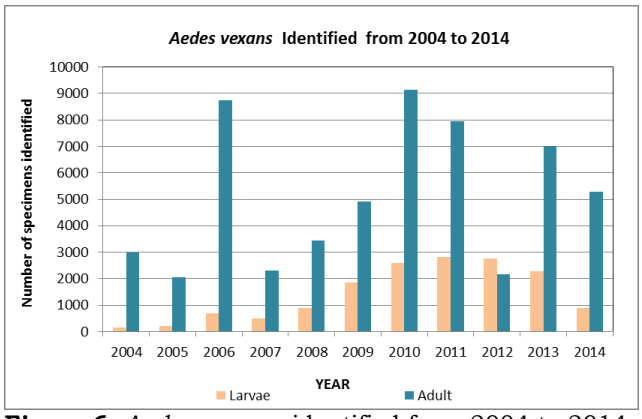


Figure 6: *Aedes vexans* identified from 2004 to 2014.

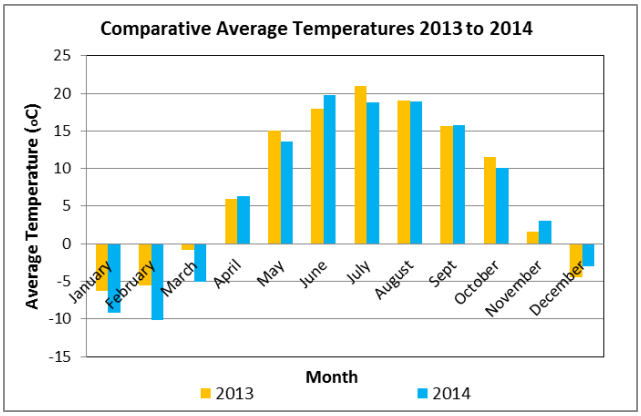


Figure 7: Average temperatures recorded in Middlesex-London, 2013 compared to 2014.

Dead Bird Surveillance

- 75 dead bird calls were reported to the MLHU in 2014.
- 8 dead birds from the Middlesex-London area were submitted for testing.
- The Canadian Wildlife Health Cooperative (CWHC) assisted in testing 4 birds this season.
- All 4 birds submitted to the CWHC were positive for WNV (2 crows and 2 blue jays). [**Appendix B**]

Weather and Potential Impacts of Climate Change

While the MLHU continues to detect WNV-positive activity each season, the risks associated with exposure to WNV due to climate change still remains low in this region. (Berry, Paterson & Buse, 2014) In general, monitoring local weather conditions can assist in understanding and explaining mosquito population trends and the potential for viral transmission. (GDG, 2014)

Mosquito population size and species composition have been shown to be influenced by rainfall and viral amplification by temperature and Accumulated Degree Days. For example, rainfall in excess of 20 millimeters can trigger populations of *Aedes vexans* and extreme temperatures can accelerate larval development and the replication of WNV within vector mosquitoes. (GDG, 2014; Patz et al., 2003)

By monitoring local weather patterns the MLHU and GDG were able to better understand the seasonal dynamics of mosquito populations in the region. Normal mean temperatures were recorded for the entire season, except for June and July; when June was 1.4 degrees warmer and July was 2 degrees cooler. [**Figure 7**] (GDG, 2014) Overall there were 7 significant rain events throughout the 2014 season (>20mm recorded). August recorded the least amount of precipitation. (GDG, 2014) [**Figure 8**]

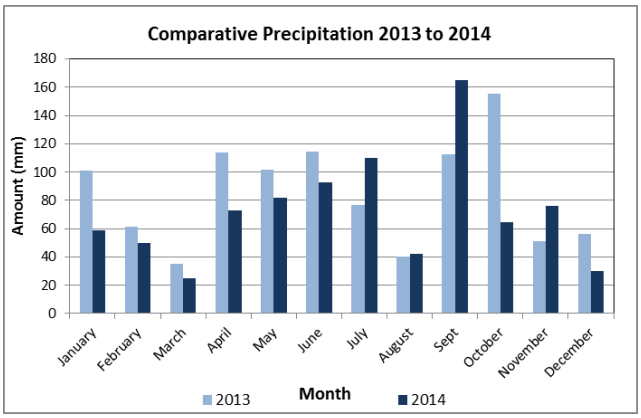


Figure 8: Amount of precipitation recorded in Middlesex-London, 2013 compared to 2014.

As climates continue to vary from year to year, vector mosquito species can be affected and potentially adapt to changes in temperature. (Patz et al., 2003) Patz et al., (2003) have identified several factors that may affect vector mosquito populations such as:

- Extreme temperatures accelerating the replication of a virus and incubation of the virus in hosts.
- Extreme temperatures modifying the development rate of vectors by accelerating life cycles and the rate at which vector mosquito species come into contact with humans.
- Vector mosquitoes adapting to temperature changes by changing geographic distribution.
- Increasing humidity which in turn increases vector survival.
- Warming temperatures increasing the length of a viral transmission season. (Patz et al., 2003)

The MLHU continues to monitor weather patterns in order to compare seasonal trends and prepare for changes to vector mosquito composition and viral transmission capacity. The factors that affect vector mosquito populations may begin to occur at the local level due to climate change.

Precipitation variability and increased rainfall can also effect vector mosquito populations and vector-borne disease transmission. Precipitation variability and increased rainfall can affect vector populations by:

- Increasing and expanding larval habitat, creating new areas for breeding.
- Hatching eggs laid on dry embankments, (sometimes several generations at a time, as observed in Parkhill in 2011) due to flooding caused by heavy snowmelt or rainfall.
- Increasing vegetation and organic matter, which supports larval mosquito development.
- Increasing container-breeding mosquitoes. (Patz et al., 2003)

Degree Days

- The 2014 season saw normal temperatures, with a low number of Accumulated Degree Days (ADD) and rain events.
- A high number of degree days will increase the viral amplification capacity of mosquitoes in a shorter amount of time.
- The threshold for calculating Accumulated Degree Days has been set at 18.3°C by Public Health Ontario.
- Typically, positive mosquito traps can appear in as few as 30 ADD, and a risk of positive human infection can appear when 180 to 200 consecutive ADD are observed (PHO, 2013).
- In Middlesex-London 50 consecutive degree days were recorded from June 21 to July 2, 2014. The first WNV-positive trap that followed was detected on July 30, 2014.
- Viral transmission did not accelerate in mosquito hosts as efficiently this season, despite ADD, because weather conditions were not favourable for WNV amplification in mosquito hosts.

Final Outcome

- An average of 223 standing water sites were visited each week for a total of 20 weeks (week 19 to week 39).
- 97% of standing water sites received at least one monitoring visit each week.
- Larvicide control treatments assisted in managing adult mosquito populations of *Culex pipiens/restuans*, decreasing populations by 26% compared to the 2013 season. [**Figure 9**]
- Decreased populations of both larval and adult *Culex pipiens/restuans* contributed to an overall low viral year in Middlesex-London, compared to previous seasons.
- Normal temperatures, with no significant spikes to accelerate viral incubation in hosts, in addition to larvicide control of vector species, contributed to a year with low WNV activity this season.

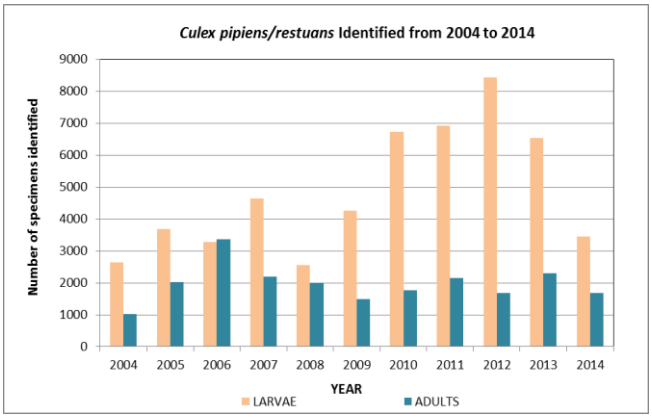


Figure 9: Comparison of *Cx. pipiens/restuans* identified in larval and adult form, from 2004 to 2014.

- 100% of WNV-positive results were reported to the public by media release and on the Health Unit's website and social media accounts.
- Additional surveillance was conducted following each WNV positive result by setting up hotspot mosquito traps in areas where the positive activity was detected. This was done to collect and test additional mosquito samples from those areas. Hotspot mosquito traps did not indicate any additional populations of WNV-positive mosquitoes this year.
- The VBD team recorded daily temperatures and Accumulated Degree Days to monitor, understand and prepare for the potential effects that temperatures and precipitation may have on local mosquito populations. Daily climate data was retrieved from Environment Canada's Daily data report (2014).
- By monitoring local weather trends and preparing for the potential impact that extreme temperatures may have on vector management activities, the MLHU has been able to mitigate the health risks associated with WNV and vector mosquito breeding.
- The 2014 seasons saw regular temperatures which did not have a significant impact on local vector-borne disease amplification. There were no extreme temperature events and consecutive degree days to support an outbreak of WNV this season; however, as climates continue to warm and change, new conditions are created and can provide viable habitats for new, invasive vector mosquito species. This has already been identified in Middlesex-London and Ontario as populations of *Ochlerotatus japonicus* continue to be identified in growing numbers each season. In future seasons vector mosquito species may continue to adapt and expand due to changes temperatures. The MLHU must be prepared to adapt surveillance and management strategies as these changes begin to occur.

- Patz et al., (2003) have noted that vector species continue to adapt to seasonal weather patterns associated with climate change. As climates continue to change, the MLHU will consider weather data and Accumulated Degree Days when planning future vector mosquito management activities. Additional activities that may be required in future seasons include: treating a greater number of catch basins or expanding public education campaigns to promote greater awareness of protective behaviours among the general public. (Berry, Paterson & Buse, 2014)
- In order to maintain a comprehensive program to mitigate the risks associated with WNV, the MLHU must continue to educate the public through interactive campaigns, distribute informative materials and maintain a strong community presence. (Fitzpatrick-Lewis, Yost, Ciliska, & Krishnaratne, 2010)
- Future plans to enhance public education include increasing the 2015 campaign to target 10,000 residents, attending a variety of relevant community events and expanding the VBD team's social media presence. Targeted messages will focus on personal protection and increasing resident knowledge and capacity to address risk factors associated with exposure to WNV and mosquito bites.

2.0 Lyme Disease

Key Messages:

- 65% increase in the number of blacklegged ticks submitted to the MLHU in 2014.
- Increase in the number of locally acquired blacklegged ticks.
- 2 travel-related LD human cases were reported to the MLHU.
- Increased active tick surveillance within Middlesex-London following the identification of locally acquired blacklegged ticks.

Background

Lyme disease (LD), a nationally reportable disease, is an infection caused by the bacteria *Borrelia burgdorferi*, transmitted to humans through the bite of an infected tick. Lyme disease is the most common arthropod-borne human disease reported in the northern hemisphere. (Kahl, Gern, Eisen, & Lane, 2002) In Ontario the LD bacterium is transmitted by the blacklegged tick (*Ixodes scapularis*), also known as the deer tick [**Figure 10**]. The LD bacterium is commonly found in mice and deer in Ontario.

Figure 10: Blacklegged tick, *Ixodes scapularis*.

Blacklegged ticks can be found across Canada. This can be attributed to host migration patterns. Since the blacklegged tick is easily transported across North America, Public Health Ontario (PHO) and the Middlesex-London Health Unit (MLHU) continue to monitor the evolving distribution of this species across Ontario and in Middlesex-London.

Tick populations are classified into categories to assist with tracking the distribution of blacklegged ticks and to understand the risk of acquiring LD in certain areas throughout Ontario. The greatest risk for exposure to Lyme disease occurs in areas where blacklegged ticks are established or endemic. (MOHLTC, 2014a) Tick populations are classified into three categories:

- **Established** - region where reproducing blacklegged ticks have been identified over multiple years in all stages of development; however, ticks have not tested positive for *Borrelia burgdorferi.*
- **Endemic** - region where blacklegged ticks are established and evidence of Lyme disease transmission has been identified between blacklegged ticks and resident animal populations. Tick and resident animal populations have tested positive for *Borrelia burgdorferi.* Active tick surveillance is conducted in regions classified as 'established' or 'endemic'.
- **Adventitious -** region where blacklegged ticks are found only sporadically.

An 'adventitious' population means that both passive and active surveillance are conducted. The risk of acquiring LD within an 'adventitious' region is low; however, it is possible. Middlesex-London has an adventitious tick population, which means that there have been some blacklegged ticks acquired and submitted from within the region; however, local tick dragging has not identified any established populations. Due to emerging habitats and host migration patterns, blacklegged ticks continue to vary by region. In Ontario, endemic and established regions with blacklegged ticks include:

1. Long Point peninsula including Long Point Provincial Park and the National Wildlife area,
2. Turkey Point Provincial Park,
3. Wainfleet bog region near Welland,
4. Rondeau Provincial Park,
5. Point Pelee National Park,
6. Parts of the Thousand Islands National Park Area,
7. Prince Edward Point, and
8. Locations in the Rainy River region of Northwestern Ontario.

Tick Life Cycle

The two year life cycle of the blacklegged tick begins when eggs are laid in the spring, and hatch as larvae in the summer. Both males and females seek a blood meal; however, male ticks do not require as much blood as females, and do not feed for long enough to transmit *Borrelia burgdorferi* to a host. It is for this reason that males are not considered vectors for LD. (Hauser, 2001) Larvae feed on mice, birds, and other small animals in the summer and early fall. The larvae may become infected with *Borrelia burgdorferi* when feeding on these animals. Once a tick becomes infected, it stays infected for the duration of its life and can transmit the bacteria to other hosts. [**Figure 11**]

Figure 11: Life stages of the blacklegged tick.

Human Surveillance

The Middlesex-London Health Unit conducts human surveillance and collects epidemiological data to understand the incidence, prevalence, source and cause of local infectious diseases. Surveillance and data collection assists in determining the biological and environmental risk factors for Lyme disease (LD) in Middlesex-London. Lyme disease is classified as both a Reportable Disease and Communicable Disease under the *Health Protection and Promotion Act*. Physicians are required to report confirmed and suspected cases to the local Medical Officer of Health, who must then report the cases to the Infectious Diseases Branch of the Ontario Ministry of Health and Long-Term Care. (MOHLTC, 2014a)

Signs and Symptoms

Lyme disease can have serious symptoms, but can be treated with anti-biotics, if caught early. Symptoms become increasingly worse if an infection remains undiagnosed and/or untreated. (PHAC, 2015) There are three stages of an LD infection. Not every person infected with LD experiences symptoms at each stage, and patients typically only experience the latter stages of infection if it remains untreated.

Stage 1: A circular, or "Bulls-Eye", rash called an erythema migrans (EM) is indicative of initial infection. [**Figure 12**] This occurs in approximately 70-80% of cases 3 days to 1 month after infection at the site of the bite. Flu-like symptoms may also be experienced.

Stage 2: This stage may last up to several months and include: central and peripheral nervous system disorders, multiple skin rashes, arthritis and arthritic symptoms, heart palpitations, extreme fatigue and general weakness.

Stage 3: This stage may last several months to years, and include chronic arthritis and neurological symptoms or adverse fetal affects in pregnant women.
In order to diagnose Lyme disease, a health care practitioner must first evaluate a patient's clinical symptoms and risk of exposure to infected ticks. A blood test may be ordered by a practitioner in order to detect the presence of antibodies for *Borrelia burgdorferi* by means of two tier testing. Initially IgM/IgG ELISA tests are performed simultaneously and if results from ELISA are positive or indeterminate, a second tier test known as the Western Blot is performed. These complimentary tests are conducted to improve accuracy. (MOHLTC, 2014a; PHO, 2012)

Figure 12: "Bull's-eye" rash circulating from tick bite. *Photo credit: James Gathany. Content provider: Centers for Disease Control and Prevention, Public Health Image Library (PHIL).*

Results

- To date, there have been no locally acquired human LD cases, however; the MLHU continues to receive reports about local residents acquiring LD while travelling.
- There were 2 travel-related human LD cases reported to the MLHU in 2014:
    - One case acquired LD in North Eastern United States (Boston, Massachusetts).
    - The other case acquired a European strain of LD in Italy.
- In 2013, there were 2 confirmed and 1 probable LD human cases reported to the MLHU. All human cases in 2013 were travel-related.

Tick Surveillance and Identification

Ticks submitted to the MLHU are identified in the Strathroy laboratory and sent for confirmation to the

London Public Health Lab. Further Lyme disease testing is conducted at the National Microbiology Laboratory.

- 91 ticks were submitted to the MLHU in 2014.[**Appendix C**]
- 71 ticks (78%) were identified as non-vector species, which means they cannot transmit LD, and 20 ticks (22%) were identified as blacklegged ticks, vector species for LD. [**Figure 13**]
- 1 of the blacklegged ticks was acquired from Prince Edward Point and tested positive for LD.
- 4 of the blacklegged ticks identified were acquired from within Middlesex-London (within the City of London, Komoka or Denfield).
- In 2014, tick dragging was conducted on 10 occasions at 7 different locations throughout Middlesex-London. [**Figure 14**]
- In 2013, 2 blacklegged ticks were acquired within the City of London. Other blacklegged ticks submitted in 2013 were acquired in the Grand Bend and Pinery Provincial Park areas.
- In 2013, the Province of Ontario reported that there were 3,039 blacklegged ticks submitted from within Ontario for testing.

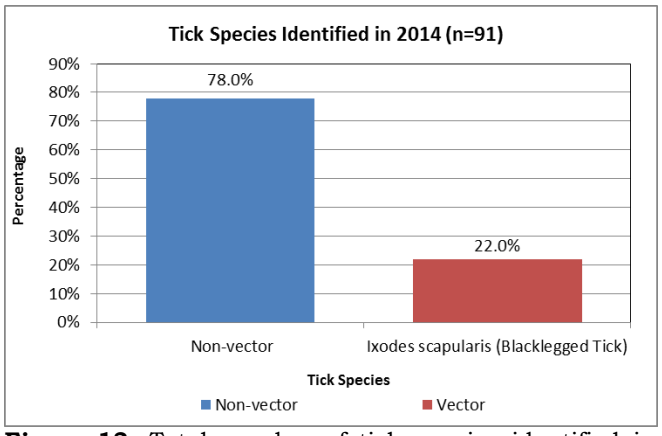


Figure 13: Total number of tick species identified in 2014.

Figure 14: Tick dragging in 2014.

Weather and Potential Impacts of Climate Change

Although the burden of climate-related vector-borne diseases remains low in Middlesex-London, the MLHU continues to monitor changing tick boundaries in order to effectively manage any potential changes that may impact the health of local residents. (Berry, Paterson & Buse, 2014) Monitoring local weather is important because warming temperatures allow previously unsuitable habitats to become more suitable for vector breeding and host seeking behaviour. (Health Canada, 2008) In 2008, Ogden et al. mapped and projected the spread of blacklegged tick populations northward, into central and eastern Canada as a result of climate change and warming temperatures. (Berry, Paterson & Buse, 2014) Through local surveillance and monitoring (PHAC, 2015; Ogden et al., 2010), these projections identified that blacklegged ticks have been dispersing into Canada at a rate of 35 to 55 kilometres per year. (Leighton, Koffi, Pelcat, Lindsay, & Ogden, 2012; Berry, Paterson & Buse, 2014) In addition to expansion in the range of blacklegged tick habitats in Ontario, an increase in human Lyme disease cases have also been observed; from 30 cases in 2007 to 317 cases in 2013. (Berry, Paterson & Buse, 2014)

At the local level, the MLHU continues to observe an increase in locally acquired blacklegged ticks each year. The MLHU currently remains classified as an adventitious region for blacklegged ticks. Tick dragging and enhanced surveillance to identify new habitats in the region will assist in adapting to any effects that climate change may have on local tick populations. Regular tick surveillance will also inform public education strategies and raise awareness on the emergence of blacklegged ticks in new areas.

The fact that Ontario continues to see an increase in human LD cases each season, in addition to the growing distribution of blacklegged ticks, reminds the MLHU that continued surveillance, weather monitoring, tick dragging, and public education are imperative in order to mitigate the risk of tick bites and LD transmission. In order to adapt to growing blacklegged tick populations, the MLHU will continue to encourage tick submission, identify ticks, enhance local tick dragging and expand education initiatives to provide updated information to stakeholders and the public. Targeted public education messages, presence in the community and distribution of strategic communication materials are some additional actions the VBD team can take to reduce risk and raise awareness. Program evaluation and administering surveys on LD will inform and help to develop new strategies for risk assessments and future program planning.

Final Outcome

- Although fewer ticks were submitted in 2014, there was an increase in the number of blacklegged ticks submitted.
- As climates change or become extreme, the VBD team will consider and refer to the adaptation options recommended by the Assessment of Vulnerability to the Health Impacts of Climate Change in Middlesex-London report. This report provided a local review of vector-borne disease activities, examining the possible health vulnerabilities resulting from climate change and its impact on local tick populations.
- The MLHU will maintain a focus on local surveillance, tick dragging and risk assessments in order to adapt, inform and prevent local LD transmission. The VBD team will expand and develop new tick surveillance strategies and risk assessments based on local submission data, identification results, changing climates and on recommendations from Public Health Ontario.
- Submission data indicated that continued education is required in order to educate residents, increase knowledge of protective behaviours, proper removal, tick submission and identification of symptoms. Follow up investigation with clients also identified that it is important to educate residents who travel to areas outside the region to participate in outdoor activities such as hiking or camping. The VBD team has identified several blacklegged ticks that local residents acquired when visiting nearby risk areas (Rondeau, Turkey Point and Long Point).
- Boundaries of blacklegged ticks continue to expand from nearby risk areas and the MLHU should be prepared to heighten local surveillance efforts if LD-carrying tick vectors continue to expand into Middlesex-London.
- In 2014, education messages were extended to local residents who travel to nearby camping and leisure areas during the tick season.
    - Targeted efforts were put in place after the MLHU started to receive an increased number of blacklegged tick submissions from residents who visited nearby regions. (i.e. the Pinery Provincial Park and Rondeau Provincial Park).
- The VBD team observed a 41% increase in pageviews of Lyme disease content on the Health Unit's website. In order to increase public engagement and the capacity to identify risk factors, the VBD team will continue to participate in local community events and distribute LD education materials, encouraging the public to visit the Health Unit's website for additional information.
- Both the MLHU and Public Health Ontario are aware that Lyme disease has continued to increase in Ontario since 2002. In 2013, there were 317 human cases of LD reported in Ontario. The incidence rate of human infection in 2013 was 1.5 times higher than the incidence rate for human infection in 2012. Although 2014 human LD results have not yet been posted for the Province, based on historical incidence rates, the number of LD-positive cases may continue to rise. (PHO, 2014a).

3.0 Eastern Equine Encephalitis

Key Messages:

- No Eastern Equine Encephalitis (EEE) positive human cases or mosquitoes have ever been identified in Middlesex-London.
- A low number of *Culiseta melanura* (primary vector for EEE) have been collected in Middlesex-London since 2011.
- Returned to the WNV testing order of preference in 2014 since trial EEE testing indicated a low number of vector species and very low risk for EEE infection in the region.

Background

Eastern Equine Encephalitis (EEE) is classified as an *alphavirus* from the family Togaviridae. In the past, EEE has mainly affected horses; however, in recent years there have been a few EEE-positive mosquitoes identified in Ontario. (MOHLTC, 2011)

There have been no known EEE human cases reported to date within Canada; however, surveillance data from Ontario health units and the First Nations Inuit Health Branch has identified the virus in some adult mosquitoes in past years. Due to these findings, Public Health Ontario (PHO) modified surveillance and viral testing protocols in 2011, advising health units to prioritize EEE-virus testing. The MLHU followed these protocols and prioritized the testing of *Culiseta melanura* along with the primary bridge vectors *Aedes vexans* and *Coquillettidia perturbans*. These protocols were set up to monitor the distribution and burden of EEE in Ontario.

Eastern Equine Encephalitis Surveillance in Ontario

Since initiating the trial EEE surveillance protocols in 2011, the following data was collected from Ontario health units:

- 249,775 EEE vector species collected and tested for EEE.
- Of the 18,177 mosquito pools tested throughout the trial one pool tested positive for EEE. A sample of *Cq. perturbans* in 2013 from the Eastern Ontario Health Unit.
- 526 mosquitoes were identified as *Culiseta melanura*.

Based on the low number of *Culiseta melanura* identified throughout the course of the trial and only one pool of mosquitoes testing positive, Public Health Ontario recommended that health units revert to the previous testing order of preference for the 2014 season. While most health units did revert, some continued to test for EEE if previous surveillance data indicated a need for continued EEE surveillance. The MLHU reverted to the original testing order of preference in 2014. This original testing order gave preference to testing more vector species for WNV, the primary vector-borne disease present in Middlesex-London.

Eastern Equine Encephalitis Surveillance in Middlesex-London

From 2011 to 2014, the MLHU's adult mosquito service provider followed Public Health Ontario's EEE surveillance protocols, conducting EEE viral tests when *Culiseta melanura*, *Ochlerotatus canadensis*, *Coquillettidia perturbans* and *Aedes vexans* were identified from samples collected within Middlesex-London. The results of this trial indicated that there is very low risk for EEE in this region due to a lack of viral activity and a very low number of competent EEE vector mosquito species. There have been no EEE-positive mosquitoes identified in Middlesex-London and only one EEE-positive horse identified in Middlesex-London in 2002. Since then, there has been no local EEE-positive activity in humans, horses or mosquitoes. Since 2011, the following data was collected from EEE surveillance in Middlesex-London:

- 11,855 EEE vector species collected and tested for EEE.
- 997 EEE viral tests performed, with no positive results.
- 48 mosquitoes were identified as *Culiseta melanura*.
- 6 *Cs. melanura* mosquito larvae collected.

Final Outcome

- Due to a lack of EEE positive activity and a very small sample of *Culiseta melanura* identified since 2011, the MLHU did not conduct EEE viral tests in 2014.
- Reverting to the standard WNV testing order of preference allowed the MLHU to conduct more focused surveillance and testing for WNV. *Aedes vexans* were one of the largest species groups tested for WNV in 2014, a group that had previously only been tested for EEE the past 3 years.
- The MLHU's scope of WNV surveillance and viral testing was expanded by returning to WNV testing order of preference. This allowed the MLHU to test an additional range of WNV vector species that had tested positive in previous seasons, but weren't tested from 2011-2013 due to the PHO EEE trial.

4.0 Mosquito Control

Key Messages:

- Achieved 97% control in roadside catch basin larvicide treatments.
- Achieved 100% control in ESA catch basin larvicide treatments.
- 14% increase in rear-yard catch basin treatments, increased awareness of backyard catch basin abatement program.
- Identified, mapped and treated 9,701 new roadside catch basins.

Background

The Middlesex-London Health Unit's (MLHU) Vector-Borne Disease (VBD) team takes an Integrated Pest Management (IPM) approach to reduce vector mosquito larvae and the incidence of adverse health outcomes related to the transmission of West Nile Virus (WNV). Controlling vector mosquito larvae is a key component in reducing the spread of infection to the public. An IPM control strategy aims to manage only vector mosquito populations while remaining economically and environmentally conscious. This comprehensive surveillance process includes the collection and identification of larval mosquito samples prior to planning and performing a larvicide treatment. This approach ensures that only those mosquito species having an adverse effect on human health are targeted.

Products and Application

All staff applying pesticide to catch basins, Pollution Control Plants and/or standing water hold either a Pesticide Technician licence or an Exterminator licence, both of which are provincially regulated by the Ministry of the Environment (MOE) and issued in accordance with the *Pesticides Act* under the Pest Management Regulatory Agency of Canada (PMRA).
In 2014, the VBD program used larvicides classified as "Class 2" by the Pest Management Regulatory Agency of Canada (PMRA). The PMRA requires that Class 2 pesticides be applied by trained and licensed personnel. Products with the active ingredient *Bacillus thuringiensis israelensis* (*B.t.i.*) were the primary larvicides used to treat standing water sites other than catch basins this season. [**Table 2**] This larvicide is biologically safe and target specific, only affecting mosquito larvae when applied to standing water with a residual life of approximately 48 hours.

A notice of application of larvicides for the purpose of mosquito control appeared in local newspapers distributed throughout Middlesex-London. In late April, notice was printed in the Dorchester Signpost (April 24), The London Free Press (May 1), The Middlesex Banner (May 1), The Londoner (May 2), the Parkhill Gazette (May 2), the Transcript & Free Press (May 2) and the Strathroy Age of Dispatch (May 2). Both the MLHU and its service provider, the Canadian Centre for Mosquito Management Inc., (CCMM) posted public notice signs at each standing water location following an application of larvicide to mosquito habitat.

Standing Water Treatments

- 4,674 visits were made to 241 standing water sites located on public property.
- 518 treatments were applied to 24.1 hectares of vector mosquito habitat. [**Table 2**]

An increase in treatment area indicates that although fewer treatments were performed, the treatments conducted were on a larger scale. Overall fewer larvicide treatments were required due to identifying a smaller number of vector mosquito larvae at standing water sites this season.

- There was a 40% decrease in the number of treatments compared to the 2013 season; however, the total area treated in 2014 increased by 33.6%.

Table 2: Number of treatments by site type.

Site type	Number of treatments	Area treated (hectares) [ha]
Ditch	57	0.4120
Field Pool	25	0.8699
Pond	29	1.03
Storm Water Management Facility	239	10.826
Woodland Pool	168	11.0
Total	**518**	**24.1**

Storm Water Management Facilities

Storm Water Management Facilities (SWMFs) require frequent surveillance and control due to their proximity to urban populations and design, which can support the development of peripheral vegetation and vector mosquito breeding. (City of London, 2014b)

- SWMFs were the most frequently treated site type in 2014.
- 46% of all larvicide treatments were applied at SWMFs sites.
- The MLHU observed a 2% increase in the number of SWMFs requiring treatment this year.

Storm water management ponds remain one of the most frequently treated sites partly due to roadside catch basins overflowing during major precipitation events.

The water and mosquito larvae housed within catch basins overflows into Storm Water Management ponds, adding additional vector mosquito populations to an already viable mosquito habitat.

Environmentally Significant Areas

- 12 Environmentally Significant Areas (ESAs) were monitored from May 8, 2014 to September 26, 2014.
- 426 site visits were made to mosquito habitat located in environmentally significant areas.
- 98 treatments were applied to a total of 9.775 hectares of mosquito habitat designated as environmentally significant. No non-target mortalities were reported. (CCMM, 2014)

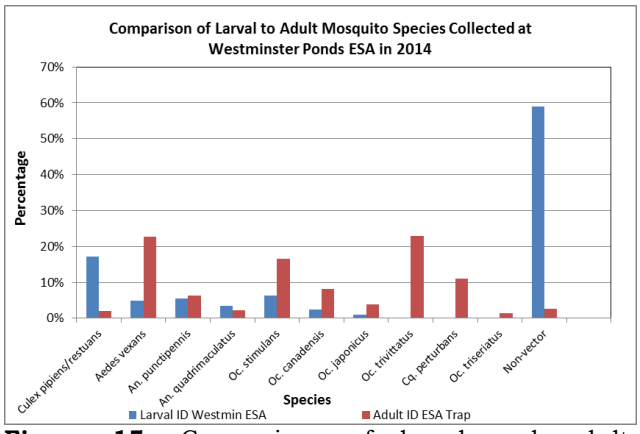


Figure 15: Comparison of larval and adult mosquitoes collected at Westminster Ponds ESA in 2014.

Figure 15 indicates that larvicide control successfully reduced vector mosquito populations at Westminster Ponds ESA. This is a significant and successful control measure because there continues to be WNV-positive activity detected in this area each season. In addition, this site is particularly important for larval and adult mosquito surveillance and control because it borders on the Dearness Home, a long-term care facility housing vulnerable populations.

Catch Basin Treatments

Catch basins can provide one of the single most significant breeding sites for urban *Culex pipiens/restuans* mosquito populations. The design of these structures are to trap water, and often this water remains stagnant for an extended period of time, allowing organic matter to collect and mosquitoes to develop. (CCMM, 2014) It is imperative that the Health Unit identify these structures and begin a timely application of larvicide in order to ensure reduced public exposure to biting WNV vector mosquito species. Early control measures ensure a significant reduction in *Culex pipiens/restuans* populations each season, contributing to decreased WNV transmission and mosquito biting.

- Larvicide applications to roadside and non-roadside catch basins were made between May 15 and August 7, 2014.
- 97,804 roadside catch basins were treated during three rounds of application.
- 66.2 kilograms of Altosid® Pellets were applied during these treatment rounds.
- 10 roadside catch basins that had outflows into environmentally sensitive areas were identified for treatment. These ESA basins were treated in each of the three rounds with one pouch of VectoLex® WSP. The ESA basins were located in Kilworth, Glencoe and Strathroy.
- 807 Altosid® XR Briquettes were applied to non-roadside catch-basins at the following locations: rear-yards of residential properties (backyard) [115]; municipal green-spaces [204]; and sites such as government buildings, social housing units, and long-term care facilities [488]. (CCMM, 2014)

Pollution Control Plants

Pollution Control Plants (PCPs) have been known to provide favourable habitat for vector mosquito breeding due to rich organic content provided in stagnant water located in sewage lagoons, settling tanks, primary, aeration and final tanks located within the city's Pollution Control Plant structures. (City of London, 2014a)

- Treatments are conducted at Pollution Control Plants every 21 days to ensure effective management of vector mosquito larvae using Altosid® Granules.
- Larval sampling at PCPs prior to treatment indicated a high number of vector larvae present in these structures [**Figure 16**].
- 82.5% of vector species identified from PCPs in 2014 were *Culex pipiens/restuans*. The remaining 16.2% of vector species were *Ochlerotatus japonicus* and *Anopholes punctipennis*.
- The first application of Altosid® was June 2, 2014, and continued until the last treatment on August 6, 2014.

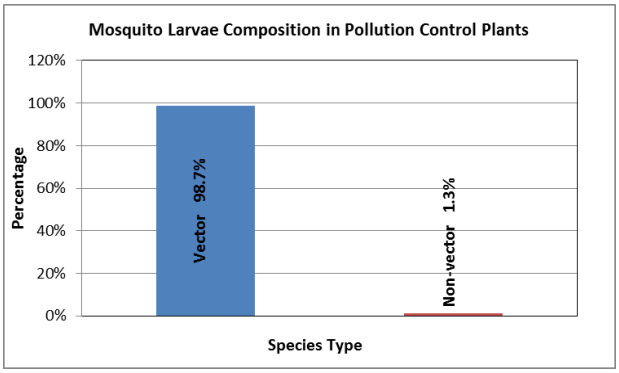


Figure 16: Vector and non-vector mosquito larvae identified in PCPs in 2014.

- 20 applications of Altosid® Granules were made to five municipal pollution control plants within the City of London.
- CCMM staff applied 2.93 kilograms of larvicide to 0.373 hectares of surface water located in off line waste water holding tanks. (CCMM, 2014)
- The PCP site treated most frequently was Pottersburg PCP located in east London. (City of London, 2014a)

Final Outcome

Mosquito control activities aim to reduce the number of vector mosquitoes in Middlesex-London. By controlling only vector mosquitoes in larval form it reduces the number of biting adult mosquitoes that could potentially transmit WNV to humans. In 2014, extensive weekly surveillance and control, along with three rounds of catch-basin larviciding, contributed to a successful reduction of WNV in the community.

- Mosquito control efficacy results indicate that treatments targeting *Cx. pipiens/restuans* larvae were successful in decreasing populations in 2014, as indicated by **Figure 17**.

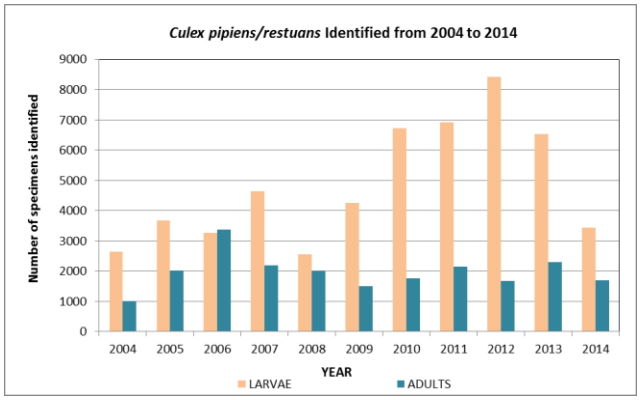


Figure 17: Comparison of larvae to adult populations of *Cx. pipiens/restuans* collected in Middlesex-London from 2004 to 2014.

Catch basin treatment ensures effective control of vector species at optimal times for mosquito breeding. Maintaining three rounds of treatment would ensure that primary vector species are managed in order to reduce the risk of exposure to local residents. (CCMM, 2014)

- 100% of projected roadside catch basin treatments were achieved, with an additional 10% increase in treatments from 2013.
- 100% of catch basins draining into environmentally sensitive areas required treatment and were treated with VectoLex® WSP, a biological larvicide. (CCMM, 2014)
- Altosid® Pellets averaged 97% control during each of the three rounds application to roadside catch basins. (CCMM, 2014)
- The effectiveness of treatment in ESA catch basins using VectoLex® WSP achieved 100% larval mortality. (CCMM, 2014)
- In total, 9,701 new roadside catch basins were identified, mapped and received at least one round of treatment in 2014.
- 14% increase in rear-yard catch basin treatments at residential properties.
- The MLHU will continue to partner with the City of London's Wastewater management division in order to control WNV vector species in and around their facilities. Due to the location of Pollution Control Plant facilities to local residential areas and the substantial number of *Culex pipiens/restuans* identified within its structures it is imperative to continue to control these highly competent WNV vector species.
- This season there was a decline in WNV-positive activity in humans, adult mosquitoes and dead birds. Decreased viral activity indicates that control measures, in addition to other factors, have helped to reduce the number of vector mosquitoes emerging, biting residents and amplifying WNV in the community.

5.0 Public Education

Key Messages:
- Reached 9,000 people at 11 community events.
- Partnered with local community members to share prevention messages and raise awareness.
- Observed increased traffic to Lyme disease web pages on the Health Unit's website.
- Expanded presence and promoted protection messages in rural areas.

Background

Public education and awareness campaigns are an important part of reducing the incidence of adverse health outcomes associated with West Nile Virus and Lyme disease infection. In accordance with the Ontario Public Health Standards, the Vector-Borne Disease (VBD) team works to increase public engagement by planning and participating in activities that increase knowledge capacity and promote behaviours change. Participating in community events and building partnerships are some key ways the VBD team works to increase public engagement.

Public education activities in 2014 included:
- Attending and sharing resources at community events.
- Working with internal partners to present to a variety of client groups.
- Targeting messages to individuals and groups, who live in rural areas, practice outdoor activities and/or those who frequent wooded or grassy areas.
- Collaborating with other MLHU service areas and community partners to promote preventative messages to a wide audience.
- Issuing media releases to inform the public when local vector-borne disease activity is detected.
- Issuing alerts on the Health Unit's website and social media accounts to inform and update residents.

A systemic review on environmental health risks by Fitzpatrick-Lewis, Yost, Ciliska, & Krishnaratne (2010) indicated that in addition to alerts and media releases to inform the public about VBD activity, the public must also receive regular information about the meaning of the alert. People may not necessarily respond to or believe the risks associated with a one-time message to protect against mosquito or tick bites. This evidence was used by the VBD team in planning a variety of education events in order to reach a large audience and increase knowledge capacity prior to issuing warning messages when VBD activity is detected. Preventative messages and public education are important actions required in order to increase protective behaviours and reduce VBD transmission. It has been observed that people understand and integrate messages more effectively when communication includes personal interaction. (Fitzpatrick-Lewis, Yost, Ciliska, & Krishnaratne, 2010) Consistent, tailored communication and messages must build trust with the public and incorporate opportunities for the public to have their questions and concerns answered. Messages should be emphasized to residents in addition to the alerts and social media updates sent out when positive activity is identified. (Fitzpatrick-Lewis, Yost, Ciliska, & Krishnaratne, 2010)

The Ontario Rural Council (TORC) encourages engagement and communication to shape and promote programs for strong, healthy rural communities. The TORC Report on Rural Health (2009) identified that access to health care in rural areas can be difficult, yet is critical to the overall wellbeing of these communities. Recommendations from this report included increasing efforts to promote wellness education and illness prevention in rural areas, enhancing partnerships, improving determinants of health and improving access to regional health services and programs in the community. (TORC, 2009) The VBD team considered recommendations made by this report in 2014 by doing presentations and attending more events in rural areas. Some of these events included Farm Day in Lucan and an information table at the Ilderton Fair.

As part of a comprehensive plan to engage and educate the public, the Public Health Agency of Canada recommends social media activities and campaigns targeting those who practice outdoor activities, as part of the Action Plan on Lyme disease. (PHAC, 2014a) Focusing on three pillars for raising awareness, the new action plan, initiated in March 2014, emphasizes:
- Engagement, Education and Awareness.
- Surveillance, Prevention and Control.
- Research and Diagnosis.

PHAC's pillars for LD action and awareness were considered by the VBD team when planning 2014 public education and engagement activities. Personal protection messages were promoted on the Health Unit's Twitter account and also at presentations and community events where residents who practice outdoors activities were present.

Results

Community Events

- Attended 11 community events reaching approximately 9,000 residents.
- Community education initiatives targeted groups that included: elementary school students (grades 3 to 8), new parents, groups who spend time outdoors, residents living in rural areas, post-secondary students, international students new to Middlesex-London, groups who practice outdoor activities and residents that spend time in wooded or grassy areas.

Events attended:

- Presentations at Well Baby/Child clinics in Glencoe, Strathroy and Parkhill.
- Presentation at the Smart Start for Babies program in Strathroy.
- Presentation at the Ontario Early Years Centre drop-in at the Dorchester Community Centre.
- Presentation to grade 5/6 environmental studies class at University Heights Elementary School.
- Interactive presentations to students at Farm Safety Day in Lucan (grades 3 to 8 at Wilberforce Elementary School).
- Information booth at Fanshawe Dragon Boat Festival and Ilderton Fair. [**Figure 18 and 19**]
- Information booth at the London Economic Development Centre's International Student Welcome Day, hosted in collaboration with Western University and Fanshawe College (Budweiser Gardens).

Resources

The following educational materials were distributed at community events:

- 1500 West Nile Virus brochures,
- 500 Lyme disease brochures,
- 500 West Nile Virus pens,
- 300 Lyme disease pens,
- 250 'Reduce and Repel' temporary tattoos,
- 500 'Skeeter swatter' fly swatters,
- 50 Frisbees,
- 25 Middlesex County Trail Guides, and
- 250 Fact Sheets.

Resources were donated to the following community events in 2014:

- Children's Health Foundation Golf Tournament.
- Make-A-Wish Golf Classic.
- Fanshawe College Wellness Fair.
- Bug Day at the London Environmental Education Centre.
- London Environmental Education Centre resource wall.
- Hunter Education Program spring safety and training day.

Figure 18: Sharing information about WNV at the Ilderton Fair.

Figure 19: Sharing information about ticks at the Ilderton Fair.

Media Monitoring

Media coverage updated and informed residents when WNV-positive activity was detected in the community. News stories promoted tick submission, protective behaviours, identification of VBD risks such as standing water and LD awareness. In 2014, media coverage included 27 stories in the news related to the VBD program. News stories about the VBD program were featured in the media from April 30 to September 9, 2014.

- 23 of the news stories were reported in newsprint and 4 were covered on the radio.
- 25 of the news stories covered topics related to WNV.
- 2 of the news stories covered topics related to ticks and Lyme disease.
- 15 of the stories were featured after the Health Unit issued media releases to report WNV-positive activity community.
- News stories were featured following media releases issued on August 1, 15, 29 and September 9, 2014.

- 6 interviews were generated from an external media request/interest in the VBD program.
- 6 announcements were printed to report on intended mosquito larviciding activities in 2014.
- Stories about the VBD program were featured by the following news outlets: AM980, CJBK, CJBK – London AM, The Focus, London Community News, London Free Press, The Londoner, Middlesex Banner, MY-FM Strathroy, the Parkhill Gazette, The Signpost (Dorchester), Transcript & Free Press (Glencoe), and the Strathroy Age Dispatch

Website and Social Media

The Health Unit's website enabled residents to report dead bird sightings, standing water concerns and learn more about WNV and LD protection.

- West Nile Virus prevention information was featured on a banner on Health Unit's main web page to promote awareness and protective behaviours following the identification of WNV-positive activity.
- 29 vector-borne disease concerns were reported through the Health Unit's website.
- 1 dead bird was reported through Twitter.
- Media releases were issued when WNV-positive activity was detected in the community.
- Media releases, protection information and links were tweeted by @MLHealthUnit and alerts were issued on the Health Unit's website.

Web Metrics

- Traffic to VBD web pages increased in 2014.
- Significant increases were observed in page views of LD content. **Figure 20** depicts some of the increases.
- Of all VBD content, "Lyme disease" was the most frequently searched term, followed by "ticks".
- In total, 141 terms related to ticks and Lyme disease were searched on the Health Unit's website.

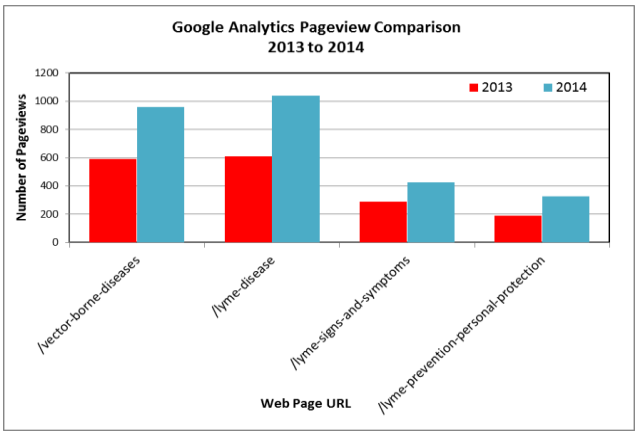


Figure 20: Comparison of Lyme disease pageviews, 2013 to 2014.

Advertising and Promotions

- 8 print advertisements were purchased.
- 2 advertisements were featured in the City of London Garbage Collection Calendar (WNV and LD). The calendar had over 136,000 copies produced and distributed to households in London.
- 8 bus transit shelter advertisements were utilized in 2014. The posters were located throughout the City of London and ran from May 26 to October 20, 2014 at the following locations:
    1. Adelaide Street N. 45m north of Kipps Lane, east side, facing north.
    2. Commissioners Road 41m east of Boler Road, south side, facing east.
    3. Huron Street 56m west of Highbury Avenue, north side, facing west.
    4. Oxford Street West 15m east of Guildwood Gate, south side, facing west.
    5. Pond Mills Road 81m south of Deveron Crescent, west side, facing south.
    6. Southdale Road 100m east of Wellington Road, north side, facing west.
    7. Southdale Road 30 west of Adelaide Street, north side, facing east.
    8. Wonderland Road 60m north of McMaster Drive, east side facing south.
- An AdTube campaign featured a Lyme disease public service announcement (PSA) ran in May, June and September and was played to users prior to viewing a video on YouTube.
- Overall, the AdTube PSA was a success; reaching a large demographic and generating 197,782 impressions and 21,175 views, with a total of 10,745 minutes watched.
- On average, 49% of the AdTube PSA viewers were male and 51% were female.
- In each of the 3 months that the AdTube PSA ran, 18 to 24 year olds viewed the PSA most often. The group that viewed the PSA second most were those aged 55 to 64. Both of these groups are important demographics for targeted LD prevention messages.

Research and Evaluation

In 2014, LD education initiatives were targeted at some of the groups identified by the 2012 Rapid Risk Factor Surveillance System (RRFSS) survey results. Additional evidence was also used to inform public education planning.

- RRFSS results indicated that males aged 20-44 years of age and parents should be a focus for LD prevention messages. These demographic groups were less likely to have heard about LD and more likely to travel and/or spend time in grassy or wooded areas.
- Survey results also indicated that education messages should highlight protective behaviours, increase knowledge of LD symptoms, and outline proper tick removal.

- Results indicated that residents did not practice personal protection methods to prevent tick bites (i.e. wearing an insect repellent that contains DEET and/or wearing light-coloured long sleeved shirts and pants).
- Public education messages were targeted to specific audiences in order to encourage behaviour change in groups identified by the 2012 RRFSS survey.
- Target groups in 2014 were residents/clients who practice outdoor activities. These audiences were reached at Farm Safety Day in Lucan, the Fanshawe Dragon Boat Festival, the Ilderton Fair and by sharing resources with the Environmental Education Centre and the London Hunter Education Program.
- While some qualitative results indicate that residents know how to remove/submit a tick, follow-up with clients identified that residents are still not taking measures to protect themselves from tick bites.
- Administering a follow-up RRFSS survey may provide a better set of data to measure the shift in uptake protective LD behaviours.

Final Outcome

- The 2014 public education campaign reached 90% of its goal to target 10,000 residents/clients.
- 100% of WNV-positive dead birds and mosquito traps detected in Middlesex-London were reported to the public. The public was informed by press release and social media alerts to increase knowledge of personal protective measures and to raise awareness about the MLHU's efforts to mitigate risk in the community.
- 4 media releases were issued following the identification of WNV-positive activity in dead birds and mosquitoes this year.
- Media releases and alerts were featured on the MLHU's Twitter account @MLHealthUnit following the identification of WNV-positive activity. These messages reached nearly 6,800 followers and community members.
- 7 of the 11 community events attended reached rural populations this season. The MLHU will continue to promote messages and services in rural areas in 2015.
- 3 of the 11 community events were attended by groups who practice outdoor activities.
- Increased traffic to vector borne disease web pages indicates that awareness is growing and the public is seeking information to increase their knowledge capacity. The following results were identified from traffic to the Health Unit's website:
    - 38% increase in vector-borne disease pageviews on the MLHU's website.
    - 41% increase in Lyme disease web pageviews.
    - 32% increase in LD signs and symptoms web pageviews.
    - 42% increase in LD prevention and personal protection web pageviews.
    - 'Lyme disease" was the 58th most common search term on Health Unit's website and "ticks" was the 78th most common search term.
    - Dead birds and dead bird submissions were also frequently searched terms.
- Results from the RRFSS survey helped to inform public education planning. The VBD team developed a plan to target messages to target groups, and identified relevant community events in order to reach those groups.
- A second RRFSS survey on Lyme disease would assist in measuring the efforts to promote protection and identify if any short and long term changes in protective behaviours have occurred.
- Continued education initiatives are required in order to target groups until a behaviour change is observed.
- The AdTube PSA promoting protective behaviours and tick bite prevention was successful in reaching the VBD team's public education campaign goals. Due to the success of the AdTube campaign in 2014, the VBD team is planning to pursue this education initiative once again in 2015.
- Maintaining a comprehensive education program, which includes attending a variety of community events, has been proven to maximize the effectiveness of risk communication. (Fitzpatrick-Lewis, Yost, Ciliska, & Krishnaratne, 2010)
- By utilizing PHAC's Action Plan on Lyme disease as a platform for public education planning, the VBD team will continue to raise awareness by identifying new activities and engagement strategies for the 2015 season.

6.0 Customer Service Requests

Key Messages:

- Received and responded to 250 Customer Service Requests (CSRs).
- 84% decrease in calls related to catch basin concerns.
- Resolved 95% of standing water concerns reported to the Vector-Borne Disease team in 2014.

Background

The Vector-Borne Disease (VBD) team continued to respond to Customer Service Requests within two business days. Intake, investigation, follow-up and reporting was handled by the VBD Coordinator and/or field technician, and in some cases, triaged to appropriate VBD staff when required. Customer Service Requests were received by phone, email, in person, or through the Health Unit's web reporting forms (the dead bird submission form and/or the web form sent through health@mlhu.on.ca). In some cases the assistance of Public Health Inspectors and other community agencies were required to assist in resolving concerns and/or achieving compliance.

- In 2014, the process for recording and collecting information for customer service requests changed. The VBD team switched to Hedgehog in the spring of 2014.
- Hedgehog provides a database system to record and track data collected from Customer Service Requests.
    - Data collected in Hedgehog represents all calls received by the VBD team related to public concerns, inquiries, standing water reports, ticks and dead bird submissions.
    - This referral system allows the VBD team to respond to requests within two business days.
- Hedgehog allows the VBD team to monitor and track Customer Service Requests and provide summary reports. Data can also be extracted for internal mapping and GIS purposes.

Results

- 250 Customer Service Requests were made to the VBD team in 2014. [**Figure 21**]
- Tick submissions were the most frequently reported public concern (35%). Dead bird reports/submissions were the second most frequent concern (30%) reported in 2014. [**Figure 22**]

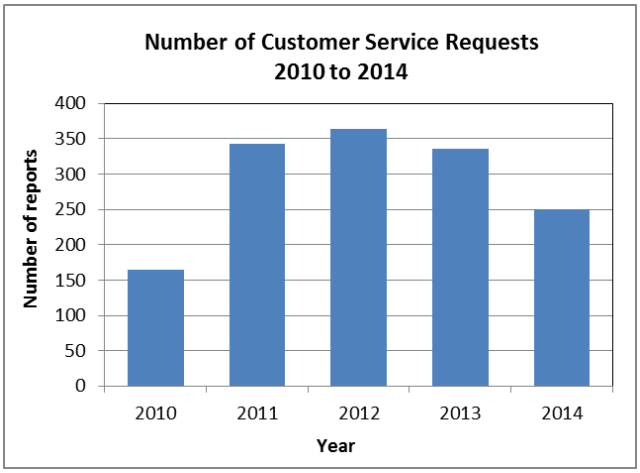


Figure 21: Number of Customer Service Requests reported to the VBD team from 2010 to 2014.

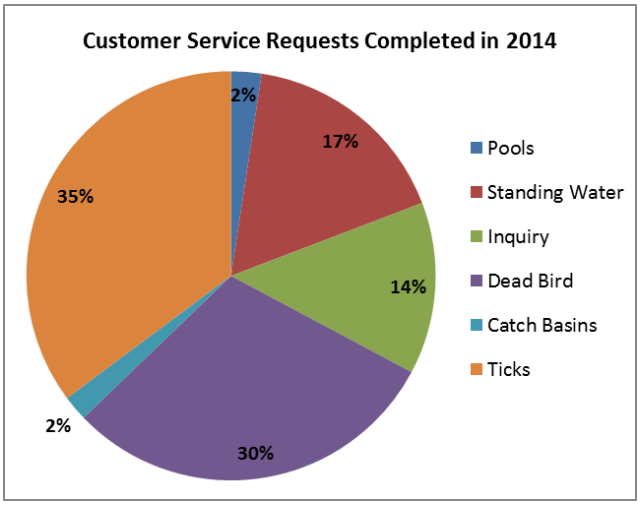


Figure 22: Type of Customer Service Requests completed in 2014.

- 5 catch basin concerns were reported, marking a decline in this type of concern for the fifth straight season.
- A 28% increase in standing water concerns was observed in 2014 compared to the 2013 season.
- Due to cooler temperatures into September and October this year, ticks were not reported as late into the season, as they were in 2013.
    - Seasonally warm temperatures late into the fall of 2013 allowed for an extended outdoor season, increasing the number of ticks reported and submitted to the MLHU in 2013.
- General vector-borne disease inquiries increased by 74% in 2014.

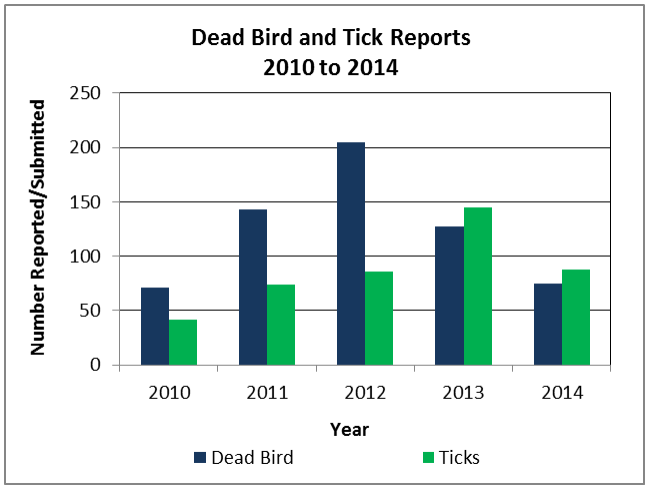


Figure 23: Comparison of dead bird and ticks reported/submitted to the VBD team from 2010 to 2014.

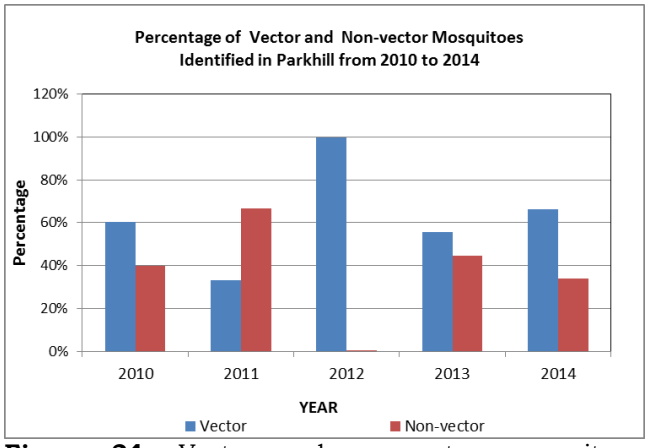


Figure 24: Vector and non-vector mosquitoes identified in Parkhill from 2010 to 2014.

- In recent years, tick reporting/submission has become the most frequent Customer Service report made to the VBD team, surpassing dead bird reporting the past two seasons. [**Figure 23**]
- Populations of adult mosquitoes remained at manageable levels in Parkhill for the third season since a high number of nuisance mosquitoes were identified in 2011. [**Figure 24**]
- Each year the MLHU collects a high number of non-vector species from this region; however, the MLHU continues to monitor adult mosquito populations in Parkhill, alerting community partners when any abnormal trends are identified.
- North Middlesex continued to manage non-vector nuisance mosquitoes with spring aerial applications of larvicide this year. This annual application is conducted separately from the MLHU's VBD surveillance and control program. Separate permits and service providers are hired independently by North Middlesex.
- For more information on the spring aerial application in Parkhill, visit: http://www.northmiddlesex.on.ca/municipal-services/mosquito-info

Final Outcome

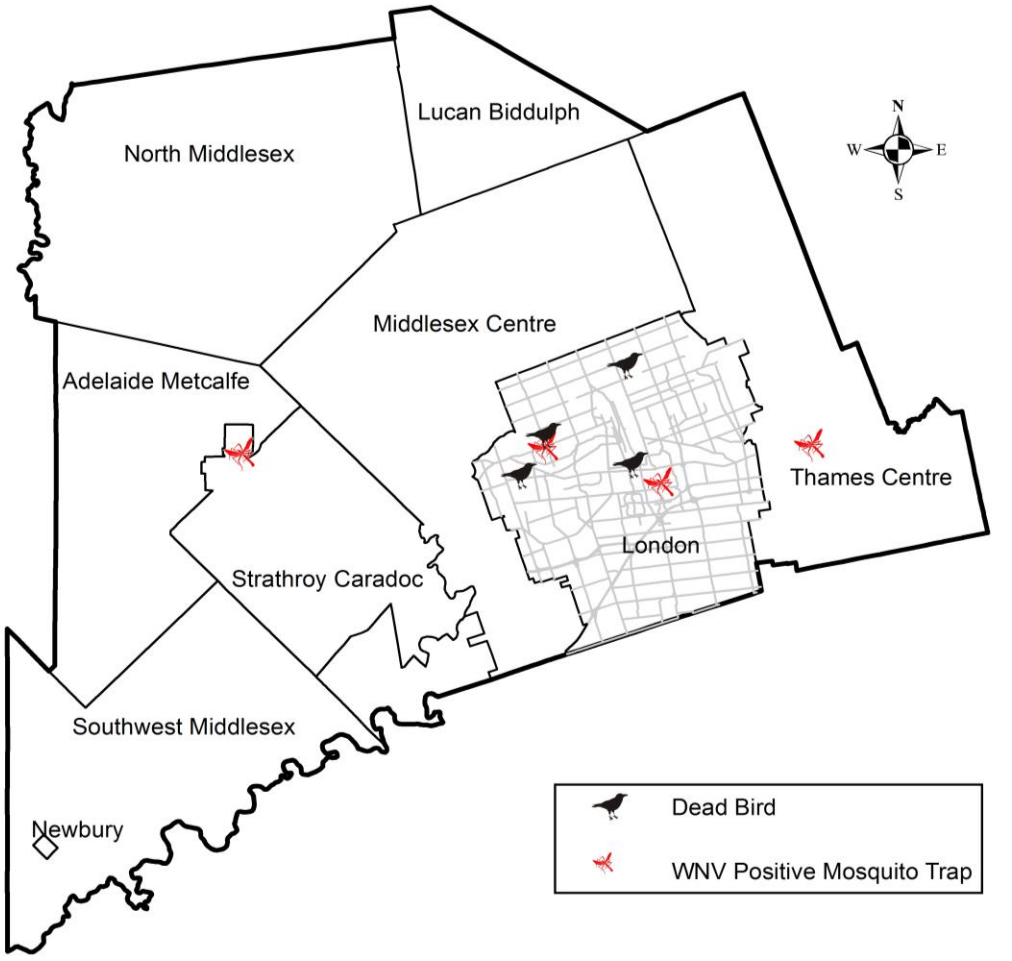
- Achieved 100% of goal to follow up on Customer Service Requests within two business days.
- Resolved 95% of standing water concerns by the end of 2014. Some concerns still remain in queue for follow up in 2015 due to non-responsive property owners. Properties cannot be accessed unless permission is granted by the property owner.
- Reached goal to reduce catch basin calls/concerns since a record number of concerns were reported in 2011. Since 2011 an 84% decrease has been observed in catch basin concerns reported to the VBD team. This is due to developing a new, streamlined communication with homeowners and initiating additional quality assurance protocols to confirm treatment.
- Increased capacity to receive and respond to customer service requests by switching to Hedgehog (a program utilized by the entire Environmental Health team to track and respond to Customer Service Requests).
- Raised knowledge and awareness by educating residents as part of the VBD investigation and follow-up procedures.
- Provided clients with resources to assist in identifying LD risk factors during investigation and follow-up on any tick or LD-related call. Resources included, referring clients to the Health Unit's website, supplying brochures, and providing instructions on how to check for and properly remove ticks.
- Partnered with 5 different community service organizations/agencies to investigate and resolve vector-borne disease concerns in 2014.
- Worked to monitor and reduce the impact of locally acquired blacklegged ticks by contacting veterinarians who referred clients and/or received reports about blacklegged ticks found on dogs. Contacting local vets who referred clients to the VBD team helped to identify areas for tick dragging within Middlesex-London. Although blacklegged ticks found on animals cannot be submitted to the Public Health Lab and tested for LD, the MLHU can conduct tick dragging in local areas where the animals may have acquired the blacklegged ticks.
- As the VBD team continues to receive Customer Service Requests related to ticks and LD each season, it is evident that awareness about LD is growing. Since awareness is increasing, it is imperative that the VBD team maintain a presence in the community in order to further enhance and promote LD prevention messages.

Appendix A: Adult Mosquito Trap Names and Locations

Trap Name	Trap Type	Location	Total Mosquitoes Collected	Positive Mosquitoes Detected
Trap A (Dorchester)	Terrestrial	Thames Centre	733	**1 positive mosquito pool (August 13, 2014)**
Can 5 (Dorchester)	Canopy	Thames Centre	782	
Trap J (Glencoe)	Terrestrial	South West Middlesex	4686	
Trap H (Parkhill)	Terrestrial	North Middlesex	9770	
Trap H-A (Parkhill)	Terrestrial	North Middlesex	1193	
Can 10 (Parkhill)	Canopy	North Middlesex	1405	
Trap I (Strathroy)	Terrestrial	Strathroy Caradoc	1615	**1 positive mosquito pool (July 31, 2014)**
Trap G (Lambeth)	Terrestrial	London	721	
Trap O (Exmouth)	Terrestrial	London	970	
Trap L (Glenora)	Terrestrial	London	1961	
Trap D (Greenway)	Terrestrial	London	330	
Can 3 (Greenway)	Canopy	London	296	
Trap F (Upper Thames)	Terrestrial	London	3912	
Trap N (CC Mews)	Terrestrial	London	2382	
Trap C (Dearness)	Terrestrial	London	2872	
Can 2 (Dearness)	Canopy	London	701	**1 positive mosquito pool (August 26, 2014)**
Trap S (Sifton)	Terrestrial	London	2295	
Can 12 (Sifton)	Canopy	London	622	**1 positive mosquito pool (July 31, 2014)**
Trap M (Huron Conservation Area)	Terrestrial	London	2910	
Can 8 (Huron Conservation Area)	Canopy	London	503	
Trap AA (Whitehills)	Terrestrial	London	2951	
Trap BB (Ilderton)	Terrestrial	Middlesex Centre	968	
Trap CC (Kilworth)	Terrestrial	Middlesex Centre	350	
UU-14	Hotspot	Dorchester	61	
VV-14	Hotspot	West London	22	
WW-14	Hotspot	South London	110	
XX-14	Hotspot	Dorchester	374	
YY-14	Hotspot	Sifton Bog	83	
ZZ-14	Hotspot	Strathroy	393	

Trap Type	Description
Terrestrial	Adult mosquito trap set 4 to 6 feet off the ground, also known as a “ground trap”.
Canopy	Adult mosquito trap set up on a rope and pulley system attached to a large tree branch, raised 13 to 20 feet off the ground.
Hotspot	Adult mosquito trap set up within a 2km radius of any WNV-positive bird, mosquito or human case reported to the MLHU.

Appendix B: 2014 West Nile Virus Positive Birds and Mosquito Traps



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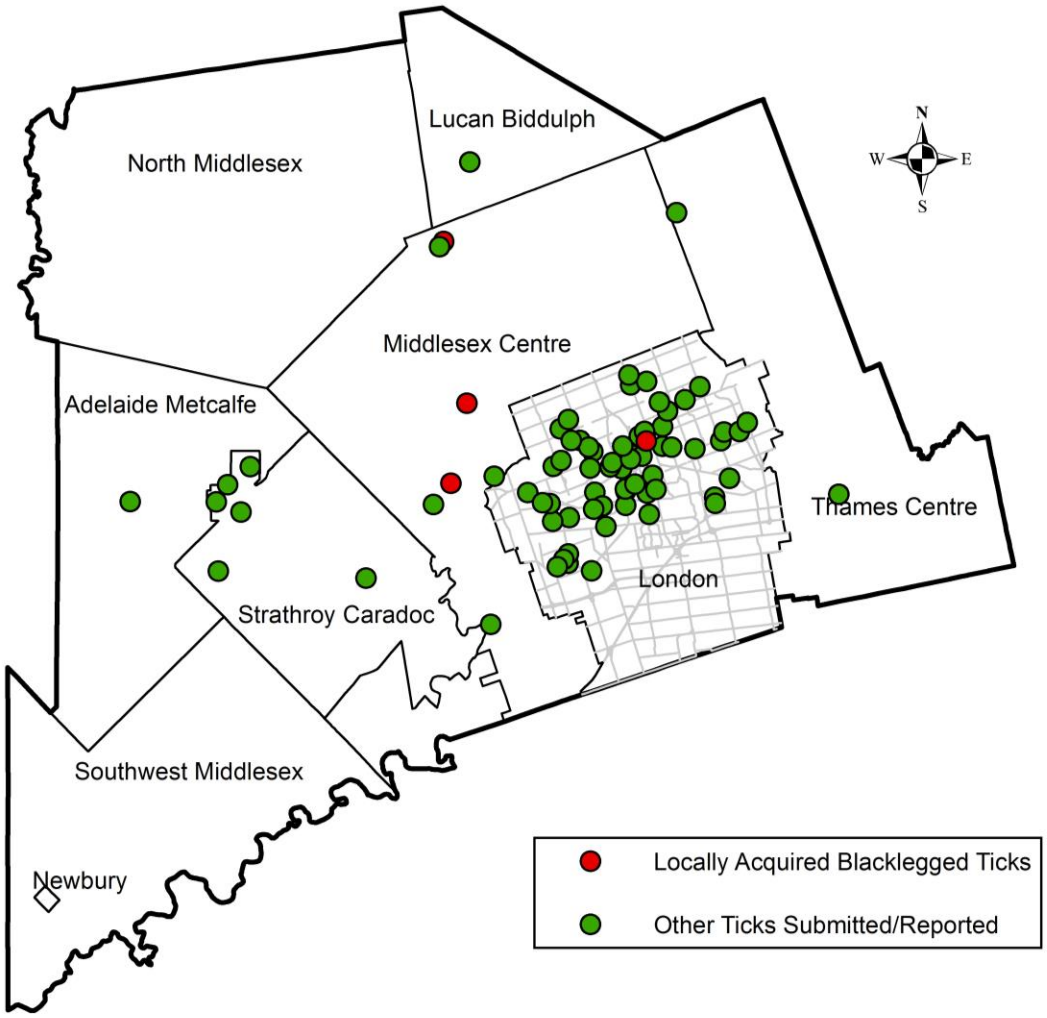
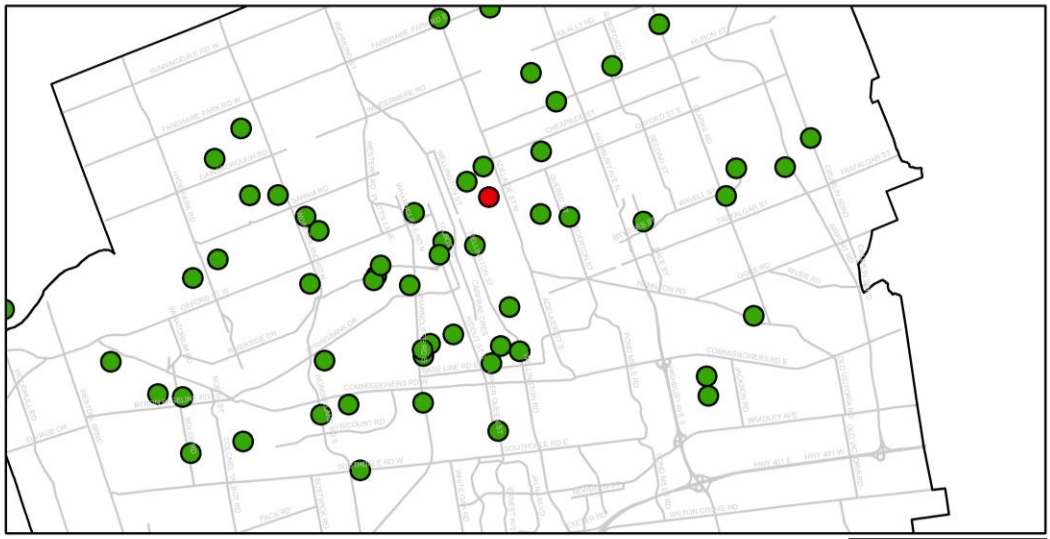
Appendix C: 2014 Tick Submissions





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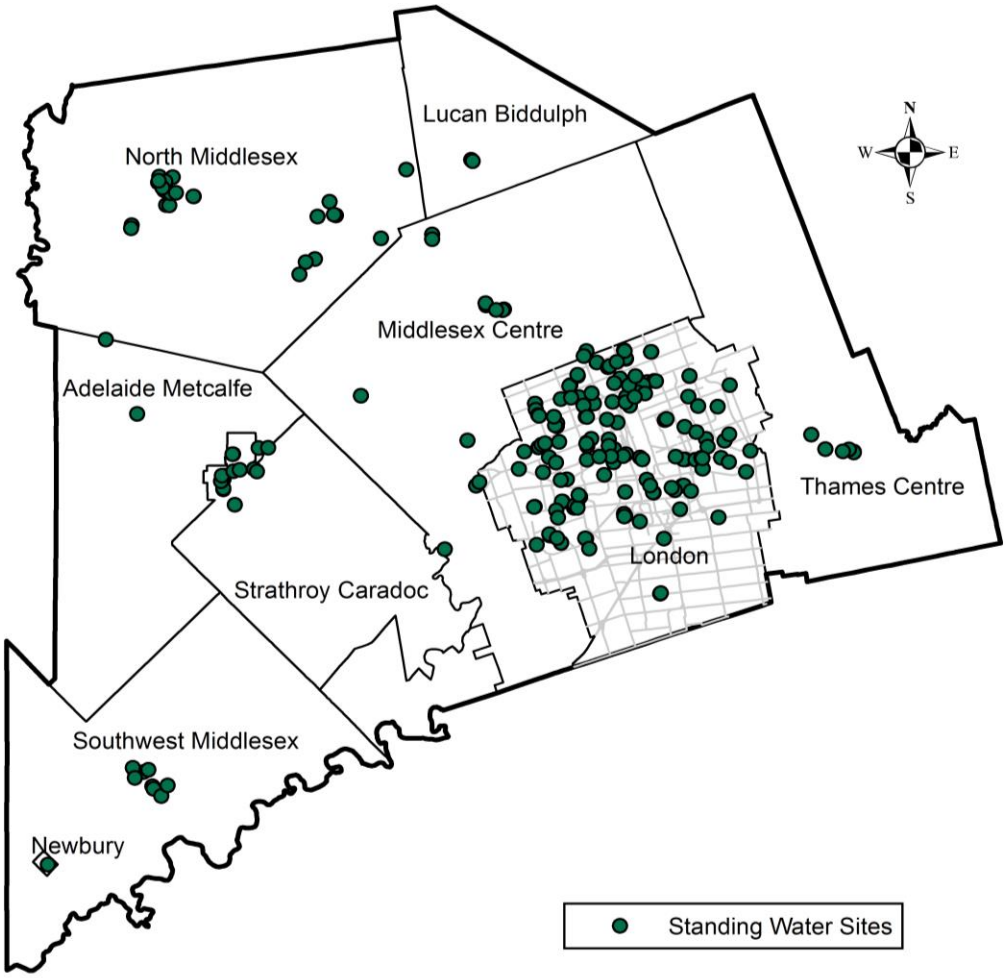
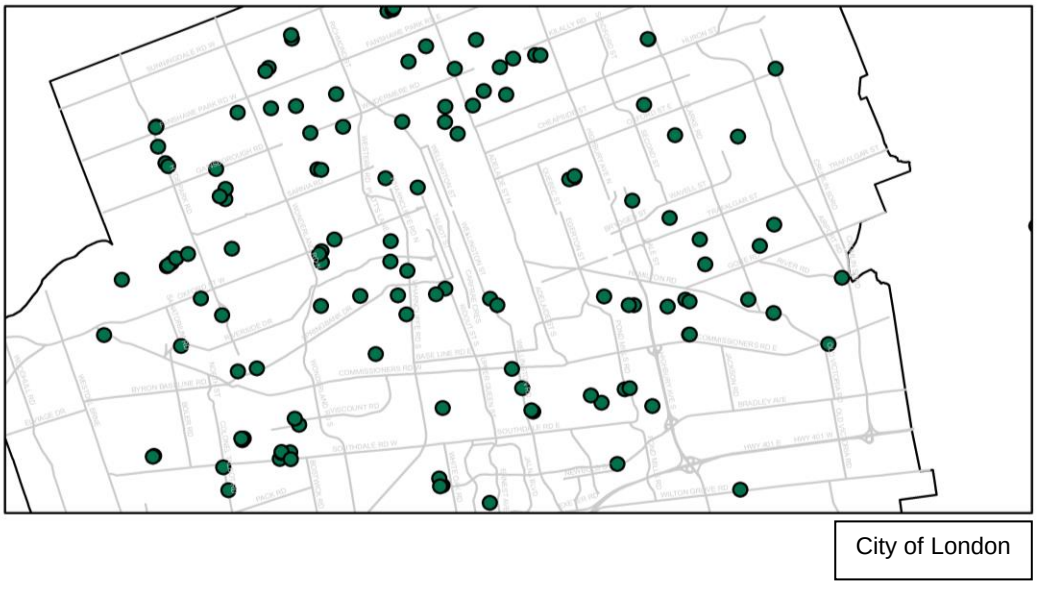
Appendix D: 2014 Standing Water Sites Monitored in Middlesex-London





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Summary and Outcomes

2014

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